Saskatchewan
Agriculture
and Food

Intensive Livestock Operations

Guide of Recommended Practice

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Purpose

Intensive livestock operations in Saskatchewan are regulated by The Pollution (By Livestock) Control Act, 1984 and The Pollution (By Livestock) Control Regulations, 1991. This Guide of Recommended Practice is intended to explain:

- how to comply with the Act and Regulations

- when and how to apply for a permit

- how to control pollution and nuisance.

Introduction

The Pollution (By Livestock) Control Act, 1984 requires operators of intensive livestock operations to obtain a permit to construct before the erection, construction or alteration of facilities for certain intensive livestock operations (ILOs).

Permit applications are available from agricultural engineers with Saskatchewan Rural Development, Extension. Information in the application is reviewed and may be referred to other agencies for comment. If the proposal meets requirements of the Act and Regulations, and is recommended by the referred agencies, a permit to construct is issued.

Permits or approval may also be required from provincial departments of Highways and Transportation, Health, Rural Development, Environment and Public Safety or from the Rural Municipality.

Definition of an Intensive Livestock Operation

Intensive livestock operation is broadly defined in the Act as "... the rearing, confinement or feeding of poultry, hogs, sheep, goats, cattle or horses." Certain ILOs require a permit.

Table 1. Calculation of Animal Unit

Kind of Animal		Number which equals One Animal Unit
Poultry	a) Hens, cockerels, capons	100.0
	b) Chicks, broiler chickens	200.0
	c) Turkeys, geese, ducks	50.0
Hogs	a) Boars or sows	3.0
	b) Gilts	4.0
	c) Feeder pigs	6.0
	d) Weanling pigs	20.0
Sheep	a) Rams or ewes	7.0
	b) Lambs	14.0
Goats		7.0
Cattle	a) Cows or bulls	1.0
	b) Feeder cattle	1.5
	c) Replacement heifers	2.0
	d) Calves	4.0
Horses	a) Colts or ponies	1.0
	b) Other than colts or ponies	2.0

Permit Required

The types of ILOs which require a permit are:

- ILOs greater than 300 animal units
- ILOs within 305 metres (1000 feet) of a watercourse or body of water
- ILOs within 305 metres (1000 feet) of a dwelling
- ILOs which include an earthen manure storage or lagoon

Table 1 defines animal units.

Many operators choose to apply for a permit even when a permit is not required.

Permits are issued only if:

- pollution of ground or surface water will not result
- the ILO will not constitute a nuisance
- adequate provision has been made for manure disposal.

Public Consideration and Development Plans

New projects in a district will interest neighbours. Some may wonder if the development meets all regulatory requirements. Before construction, discuss the project with neighbours, municipal authorities and agricultural engineers with Saskatchewan Rural Development. Allow them the opportunity to review and understand your plans so questions may be answered correctly before serious misunderstandings develop. Be sure to explain the positive impacts the development will provide.

For large proposals, applicants may be asked to outline their plans at a public meeting. A complete, written development plan of the proposal will demonstrate the proposal is well thought out.

The development plan should explain:

- the size and type of facility
- the number and kind of animals
- provisions for manure storage and disposal
- provision for disposal of dead animals or birds
- reasons for site selection and alternate sites which were considered
- social and economic benefits for the community

Describe how potential problems will be overcome and how the community will benefit from new jobs, markets for feed grain, and economic diversification.

Procedure for Establishing an Intensive Livestock Operation

1. Become familiar with The Pollution (By Livestock) Control Act, 1984, the Regulations, and Guide of Recommended Practice.
2. Prepare a development plan which explains your proposal.
3. Evaluate alternate locations or sites. Document your process as much as possible and include the rationale for rejecting or accepting particular locations or sites in the development plan.
4. Make offers to purchase conditional on receiving a permit under The Pollution (By Livestock) Control Act, 1984.
5. When dealing with funding agencies, be aware of any conditions relative to the environment.
6. Work in a cooperative spirit with the community, Rural Municipality, Rural Development Corporations and Planning Authorities. Identify jobs, contracts, and spin-off industry benefits.
7. You may be asked to contract an independent consultant for soil tests for manure storage design. A list of possible consultants is available.
8. Written consent from neighbours is requested:
   - if your site is within the minimum recommended distances
   - for manure spreading land if you do not control sufficient land.
9. An agricultural engineer with Saskatchewan Rural Development will assist you in preparing an Application for Permit and Detailed Report. The Application for Permit and Detailed Report are legal documents.
10. Following issuance of a permit, information contained in the application, detailed report, development plan and any appended plans is binding. A new permit is required if there is significant change in information or circumstances prior to construction.
11. When an Application for Permit and Detailed Report are received by Saskatchewan Agriculture and Food, it may be circulated to some or all of the following agencies for comment:
    - Saskatchewan Health, Community Health, Prevention Services Branch
    - Saskatchewan Rural Development, Municipal Services Branch
    - Saskatchewan Parks and Renewable Resources
    - Saskatchewan Environment and Public Safety
    - Saskatchewan Water Corporation
    - Rural Municipality
    - Other agencies or groups which may be affected

    The agencies will be given 40 days to respond. If any one of the agencies raises objections, you will be requested to address the concerns. In some cases, a public process may be requested.
12. When outside agencies are consulted, about 50 days are required for a decision.
13. You may be required to meet special conditions which are a part of the permit.
14. Some proposals may be recommended for initial screening under The Environmental Assessment Act, 1980.

Agencies to Contact for Additional Information

Saskatchewan Rural Development, Extension

Extension agricultural engineers (see map on page 14) provide the first contact for persons planning to establish an ILO. They can provide advice on which, if any, of the other agencies an applicant should contact for more information.

Rural Municipality

Information on development permits, subdivisions, land use and zoning.

Saskatchewan Rural Development, Municipal Services

Information on local zoning bylaws and subdivision requirements.

Saskatchewan Water Corporation

Information on developing wells, providing drainage or constructing in restricted areas.

Saskatchewan Health, Community Health, Prevention Services Branch

Information from the local Public Health Inspector on permits or approvals required under The Sanitation Regulations.

Saskatchewan Highways and Transportation

Information on permits if close to a provincial highway.

Saskatchewan Environment and Public Safety,

Environmental Assessment Branch

Information on The Environmental Assessment Act, 1980, public process and development plans.

Air Quality Branch

Information on permits for incinerators.

Saskatchewan Soil Testing Laboratory

Information and procedures on collecting soil samples for sieve analysis.

Saskatchewan Parks and Renewable Resources

Information from the local Conservation Officer or Park Management and Development Program on local projects and development programs.

Site Selection

Choosing the site for an intensive livestock operation is a very important decision. The establishment of an ILO is very expensive and relatively permanent. It is not easy to make changes after the fact.

Criteria to consider are:

- room for expansion
- utilities - water, power, sewer, telephone
- access
- isolation from other ILOs
- topography and drainage
- soil type
- feed supply
- distance to market
- availability of labour, supplies, support services
- availability of land for manure spreading
- zoning and subdivision requirements
- permit requirements
- surrounding land use
- isolation from neighbours and urban centres
- visibility from the road and to neighbours
- groundwater
- surface water
- acceptance by neighbours

Control Works, Holding Ponds and Manure Storage

Manure and contaminated runoff from an ILO must be contained on the operator's property until properly removed. Diversion ditches, dykes or dams may be needed to contain runoff. Agricultural engineers with Saskatchewan Rural Development may design control works or recommend a capable agency or consultant.

Divert uncontaminated runoff around the facility to minimize the size of holding pond (Fig. 1). Holding ponds are designed to contain a 75 millimetre (3 inch) runoff from the area of enclosure. Shallow ponds with large surface areas allow greater evaporation, require little maintenance and may be cropped. If a deep holding pond is necessary, pump the liquid and spread it on cultivated land. Holding ponds in porous soils near water supplies require a lining of impervious soil or other material. Holding ponds are considered part of the intensive livestock operation when measuring separation distance.

Construct earth structures with side slopes of two to one. The minimum top width of dykes is 1.2 metres (4 feet). If vehicles will travel on the dykes, the width should be 2.4 to 3 metres (8 to 10 feet). Optional four to one slopes on outside embankments allow for ease of mowing. Dykes and holding ponds require a freeboard of 300 millimetres (1 foot). Earthen manure storages require a freeboard of 600 millimetres (2 feet).

Construction of an earthen storage (Fig.2) in environmentally sensitive areas may not be allowed or may require special design. Construction of any earthen manure storage requires soil analysis to determine if there is potential for contaminating groundwater. Soil analysis may be performed by the Saskatchewan Soil Testing Laboratory or other agency capable of providing a sieve analysis of the location soil. Agricultural engineers with Saskatchewan Rural Development can assist in interpreting the results of a soil analysis.

Manure Management

The manure by-product of intensive livestock operations is a valuable resource. To recover the full value of manure, intensive livestock operators should budget for adequate means of storage and disposal.

Solid Manure

Solid manure systems utilize straw, wood chips or other absorbent material for bedding. Manure is handled as a bulk product. Solid manure is the typical by-product of beef cattle feedlots or other dry lot areas. It is common in dairy and poultry confinement housing systems. There is increased interest in bedded manure systems for swine.

Liquid Manure

Liquid manure systems were developed to provide operators with a more efficient method of storing and utilizing large quantities of manure.

Liquid manure may be stored within the facility, in covered or open tanks, or in earthen manure storage. Before choosing the type of storage, consider the impact each system may have on neighbours, yourself and the viability of your operation. Evaluate odour nuisance, frequency of spreading and utilization of nutrient for each option. Document and include your evaluation as part of your development plan.

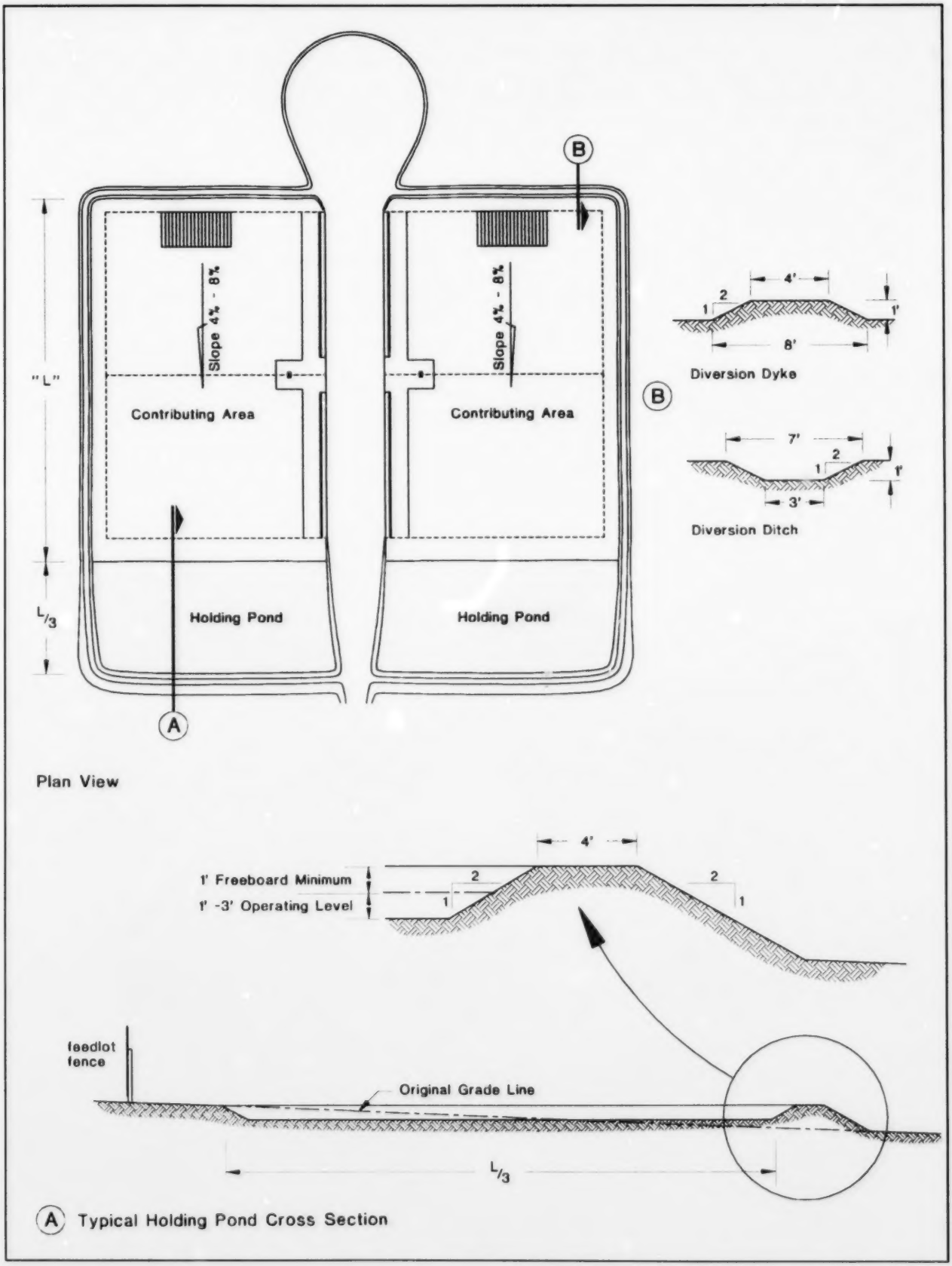

Figure 1. Typical feedlot and control works.

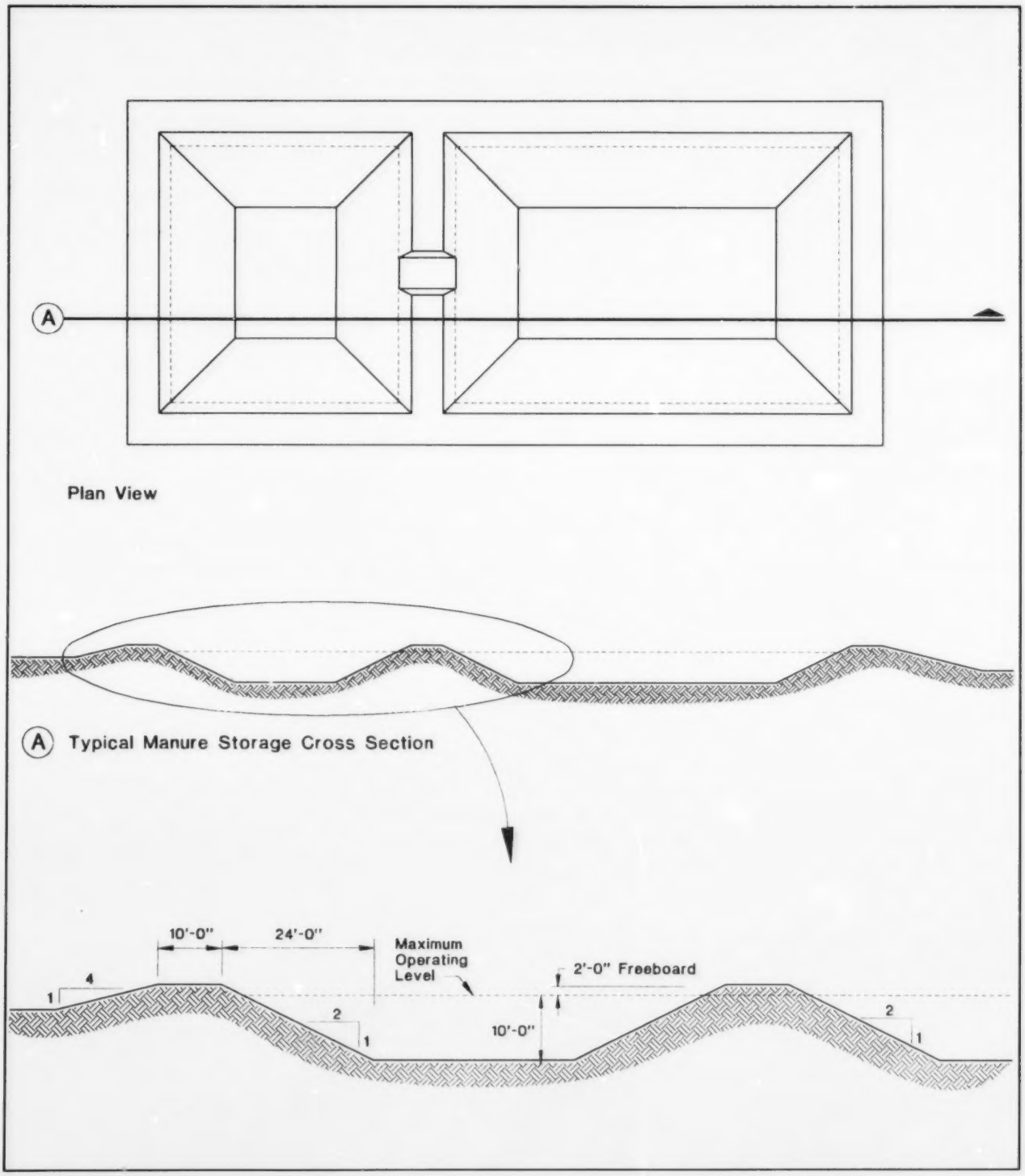

Figure 2. Typical earthen manure storage.

Manure Utilization

An ILO operator must utilize manure in a way which will not cause pollution or nuisance. Methods which provide optimum nutrient utilization result in minimum impact from odour and flies.

Solid manure is usually spread by mechanical manure spreaders or by dumping in piles and incorporating with field machinery. Tillage within 24 hours of spreading is recommended. This provides maximum nutrient retention, and minimum impact due to odour and flies.

To reduce odour nuisance frequency, schedule application of solid manure annually or semi-annually. Spreading on frozen ground, or where manure cannot be incorporated, is acceptable only for isolated areas with low potential for pollution. By mounding manure in drylot areas, pens will dry faster and allow manure to be used in the spring. Early removal of manure from drylot areas reduces flies and odour and improves animal performance.

Liquid manure is utilized by broadcasting, injection or irrigation. Direct injection of manure provides the greatest nutrient benefit, least conflict potential and is recommended for sensitive areas. Tillage immediately after broadcasting will approach the effectiveness of direct injection. Irrigation of liquid manure through big guns is relatively cheap and convenient; however, nutrient utilization is low. Application of liquid manure through big guns is limited to isolated areas where potential for odour nuisance and pollution is low. When manure is broadcast on the soil surface, tillage within 24 hours is recommended.

Area Requirements for Manure Utilization

Depending on type of manure and crop management system, 0.2 - 0.8 hectares (one-half to two acres) of cultivated crop land per animal unit is required for manure utilization. It is the operator's responsibility to assure adequate land is available for manure utilization. Land areas receiving continuous annual applications of manure must be closely monitored to optimize nutrient use and to prevent serious long-term problems from occurring. Where availability of land is limited, a qualified soil scientist (professional agrologist) should be consulted to provide a soil and crop management program for manure utilization.

Best Management Practice (BMP)

The concept of "best management practice" is being implemented in areas where manure production closely matches the area available for utilization. Under a best management program, nutrients are applied, through manure or fertilizer, at a rate which provides only the amount of nutrient required for the crop that year. By applying nutrients at a rate equal to crop use, excess nutrients are not available to contaminate water. Nutrient levels required for the crop are determined by soil analysis prior to seeding. By analyzing the manure for nutrient content, the proper application rate can be determined. Regular analysis of soil also provides the opportunity to identify potentially negative effects such as salinization or nutrient imbalance.

ILO operators should have direct control of adequate land and equipment to utilize manure. This allows the operator to realize the maximum economic benefit of manure and to implement management practices which alleviate pollution and maintain air quality.

For ILOs which do not control the land or equipment required for manure utilization, long-term contracts with neighbours are recommended which specify:

- how much land is available
- who will buy, operate and repair removal equipment
- method of application
- length of the agreement
- minimum of one year notification to discontinue contract

Air Quality

The effect of an intensive livestock operation on air quality is one of odour nuisance, rather than public safety or health. Although most ILOs do not have a significant effect on air quality, most complaints against ILOs relate to odour nuisance.

Odour nuisance is a function of the frequency, intensity, duration and offensiveness of the source odour. The odour nuisance can be described by the FIDO equation.

Odour Nuisance =
Frequency x Intensity x Duration x Offensiveness
= FIDO

A change to any one of the FIDO factors will change the odour nuisance level.

Manure odour from ILOs originates from these areas:

- building or facility
- manure storage
- disposal area

Buildings and Facilities

Maintain air quality near facilities by following a disciplined manure and animal management program. For livestock confined outdoors, provide well-drained drylot areas. Mound manure in the pens regularly during winter for use as bedding mounds and remove as early as possible in the spring.

For animals housed indoors and using liquid manure systems, minimize the accumulation of manure in the barn by removing regularly to medium or long-term storage. Ensure animals are dry and establish good manuring habits by keeping clean facilities.

For animals housed indoors and using solid manure systems, provide an adequate amount of bedding or litter to maintain animal comfort and keep the manure dry. Although the trend was away from solid manure systems for animals housed indoors, there has been increased interest in bedded manure systems in response to animal welfare concern. Before establishing a new ILO, give serious consideration to emerging technologies in manure handling and animal care.

Even with top management, a minimum separation distance is recommended between ILOs and receptors. Minimum recommended separation distances are given in Table 2 and shown in Figure 3.

Table 2. Minimum Recommended Separation Distance for Locating Intensive Livestock Operations

	Animal Units				
Population	10-50	50-300	300-500	500-2000	> 2000
Rural Residence	1000 feet	1000 feet	1/4 mile	1/2 mile	3/4 mile
< 100	1/4	1/4	1/2	3/4	1
100-500	1/4	1/2	3/4	1	1.5
500-5000	1/2	3/4	1	1.5	2
> 5000	1/2	1	1.5	2	3

The recommended separation distance from open liquid manure storage is 1.5 x the above distances.

	Animal Units				
Population	10-50	50-300	300-500	500-2000	> 2000
Rural Residence	305 m	305 m	400 m	800 m	1200 m
< 100	400	400	800	1200	1600
100-500	400	800	1200	1600	2400
500-5000	800	1200	1600	2400	3200
> 5000	800	1600	2400	3200	4800

The recommended separation distance from open liquid manure storage is 1.5 x the above distances.

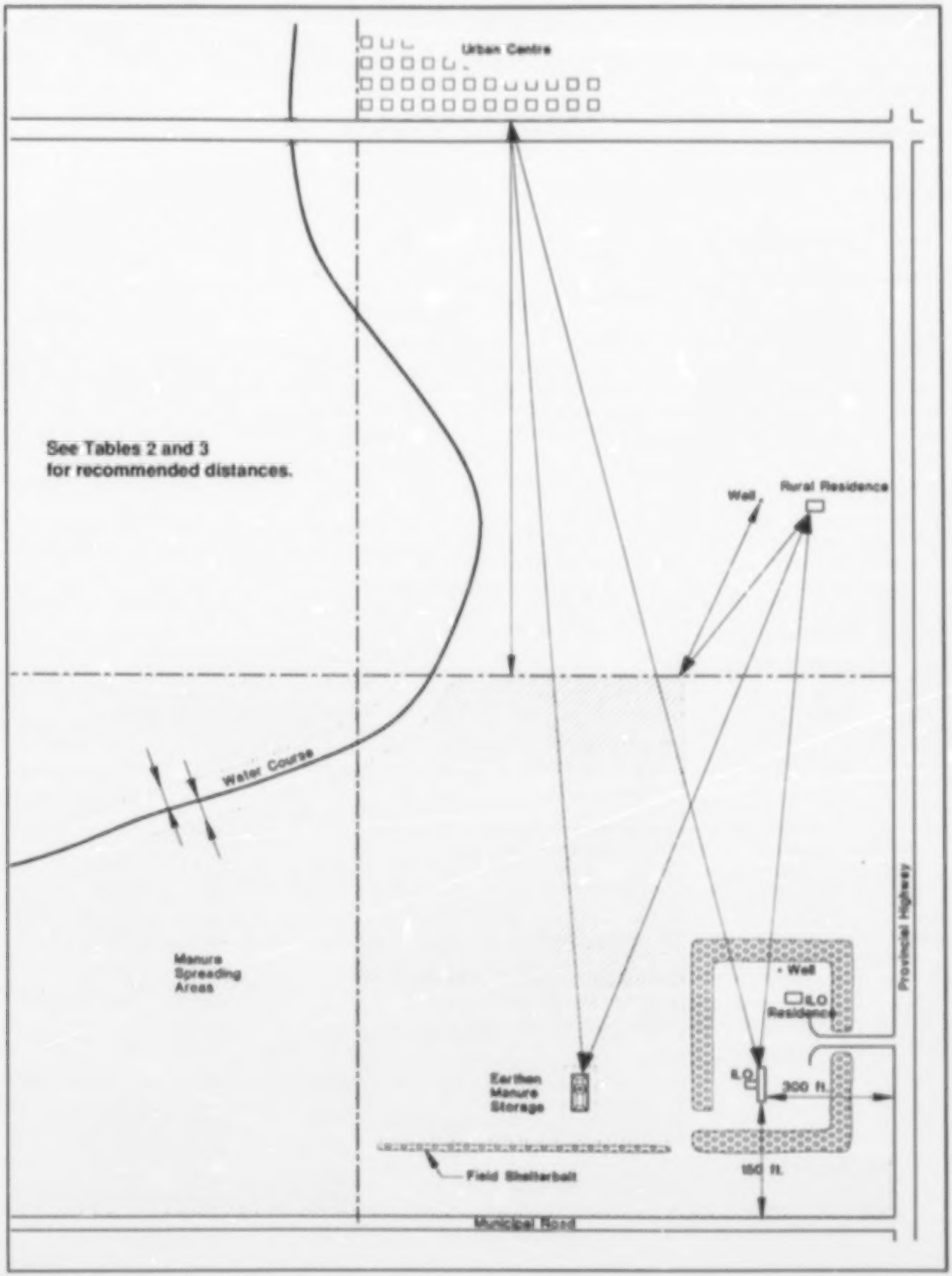

Figure 3. Isolation distances for livestock facilities.

Manure Storage

Manure from solid manure systems is usually mounded within the facility until spread on the land. With proper management, solid manure can be composted. Composting is an aerobic (with oxygen) process and, when managed properly, has little or no effect on air quality. If located near a market for compost, composting may be a sound economic decision.

Air quality near liquid manure storage is variable. Odour near covered storage is comparable to the odours of the building or facility. The recommended separation distance required to disperse odours is the same. A 50% increase in separation distance is recommended for open liquid manure storage.

Even with generous isolation distances, there may be a need to implement improved management practices which maintain air quality near open liquid manure storage. Some alternatives follow:

Emptying in the spring

This removes manure which has become very anaerobic during the winter, and keeps the effluent level below grade. Light breezes or inversions are less likely to pick up the odour. The total amount of manure contributing to odour is reduced.

Manure treatment

Anaerobic (without oxygen) decomposition of manure results in offensive odours. By adding oxygen to manure (aerating), decomposition becomes aerobic. Aerobic decomposition is similar to composting and odours are much less offensive. Aeration of manure is expensive and not usually economical.

There are a number of manure pit additives available which claim to remove or reduce odour from manure. These products can be quite expensive, and should be subjectively evaluated.

A relatively new method of treating manure called oxyoglysis has been demonstrated to reduce production of hydrogen sulphide from manure. The process involves electrifying a grid of iron rods placed in the manure. This process has not been adequately developed for field scale use.

Covers

When covered storage is selected over open storage, capacity is usually reduced to compensate for cost, which increases spreading frequency. The benefit of covered storage should be weighed against the increased frequency of spreading. Covers can be of three types:

- rigid - concrete, wood, fibreglass
- flexible - plastic, canvas, supported, unsupported or floating
- organic - straw, peatmoss, wood chips or other organic materials

Straw availability and the ability to adapt to existing storage, particularly earthen manure storage, make organic annual covers one to consider. Methods of applying the straw and improving its longevity are being developed.

Manure Spreading

Odour nuisance during spreading is a regular and unavoidable situation. Table 3 gives minimum recommended separation distances for manure spreading areas. To maintain air quality during manure removal, the following is recommended:

- inject liquid manure into the soil whenever possible
- incorporate broadcast manure within 24 hours
- inform neighbours well in advance to avoid conflicting events
- spread when weather conditions are favourable and air quality can be maintained
- observe minimum recommended separation distances for manure spreading areas
- perform disposal annually or semi-annually as quickly as possible

Table 3. Minimum Recommended Separation Distances for Manure Spreading Areas

From	To manure spreading areas: tilled within 12 hr.	To manure spreading areas: not tilled within 12 hr.
Rural Residence	1000 feet	1/4 mile
< 100 population	1/4 mile	1/2 mile
100-500	1/2 mile	1 mile
500-5000	3/4 mile	1 mile
> 5000	1 mile	2 miles
Water well or spring on land not controlled by the ILO operator	300 feet	300 feet
Watercourse or body of water not contained on land controlled by ILO operator and to which runoff water will not flow	100 feet	100 feet
Watercourse or body of water not contained on land controlled by ILO operator and to which runoff water will flow	100 feet	1000 feet

From	To manure spreading areas: tilled within 12 hr.	To manure spreading areas: not tilled within 12 hr.
Rural Residence	305 m	400 m
< 100 population	400 m	800 m
100-500	800 m	1600 m
500-5000	1200 m	1600 m
> 5000	1600 m	3200 m
Water well or spring on land not controlled by the ILO operator	100 m	100 m
Watercourse or body of water not contained on land controlled by ILO operator and to which runoff water will not flow	30 m	30 m
Watercourse or body of water not contained on land controlled by ILO operator and to which runoff water will flow	30 m	305 m

Pest Control

Flies

A good fly control program integrates cultural, biological and chemical suppression methods.

Cultural control of flies involves managing manure, feed, and facilities to reduce fly breeding areas. Remove manure frequently and keep it dry to reduce habitat for fly larval development. Prevent feed spoilage and reduce spilled feed.

Biological control methods enhance and preserve naturally occurring predators and parasites which destroy adult flies or fly larvae. This includes steps to keep the manure as dry as possible. In very wet manure, naturally occurring predators cannot move about to find and consume eggs or larvae. Besides naturally occurring predators, facilities can be stocked with predators such as Muscovy ducks or parasitic wasps to enhance fly control.

After maximum effort to suppress fly numbers by cultural and biological methods, there is often a need for insecticides. Choose chemicals carefully. Alternate chemical types to prevent flies from becoming chemical resistant. Any insecticide used must be labelled and registered for the intended use.

Potential Fly Breeding Sites

Manure accumulation areas

- Bedding mounds
- Maternity stalls
- Sick pens
- Fence lines and corners which are difficult to clean
- Manure pits
- Debris and floating mats on lagoons
- Wet litter under leaking waterers

Feed and bedding storage areas

- Feed bunks
- Creep feeders
- Self feeders
- Waterers
- Hay stacks, silage pits and silos
- Spilled feed around augers, bins and processing areas

General areas

- Dead animals or birds
- Broken eggs
- Poorly drained areas

Control Measures

Remove manure regularly and during cool weather; spread as quickly as possible, weather permitting.

Keep manure dry and reduce sources of open water by:

- providing good drainage
- repairing leaky waterers

Install concrete aprons around feeders, waterers and feed bunks.

Remove spilled feed weekly.

Remove dead animals and birds within 24 hours.

Implement insecticide treatment by means of sprays, bait stations, larvicides and misting.

Rodents

The critical factors required to support a rodent infestation are food, water, suitable climate and shelter. Improperly handled feed is a major source of rodent food. Combined with the shelter of buildings, ILOs provide an excellent environment for rodents.

Four steps required to control rodents are:

1. Food source removal
2. Shelter reduction
3. Rodent proof buildings
4. Destroy rodents

Reduce available shelter by removing piles of wood and junk. Destroy old buildings, especially granaries. Contact an agricultural engineer with Saskatchewan Rural Development to obtain publications on rodent proofing farm buildings.

Poisoning is an essential component of a rodent control program. If rodents are present, poisoning may be initiated prior to an overall cleanup program. If shelter and food sources do not exist or have been eliminated, establish permanent bait stations and monitor.

Dead Animal Disposal

Dead animals from intensive livestock operations must be disposed of safely and cleanly. Four disposal methods are:

- *burial pits*
- incinerators
- rendering plants
- composting

Burial pits are the most common type of dead animal disposal. Locate burial pits in an isolated area, away from watercourses and where access by predators is limited. Construct the pit in a well-drained area at least 90 metres (300 feet) from a watercourse, body of water or water well. Pits should be a minimum 1.5 metres (5 feet) deep, and the carcasses covered with 1 metre (3 feet) of soil. Do not construct pits in porous soils or where there is a high water table.

Incinerators can provide a convenient means of disposal for small animals and poultry. For large ILOs located on small land holdings, incineration may be required for the disposal of carcasses. A permit from Saskatchewan Environment and Public Safety is required.

Rendering plants may be the most convenient means of dead animal disposal. For large operations, a regular pickup schedule for carcasses may be arranged. Store carcasses in tight containers until picked up. Specific arrangements can be made between the ILO and the rendering company.

Composting of small animals, especially poultry, is possible. Details are available from Saskatchewan Rural Development agricultural engineers.

Provide specific details of the proposed method of disposal in the development plan.

For further information, contact your extension agricultural engineer at one of the following offices of Saskatchewan Rural Development: